Self Test Function

OBJECTIVE

How to use the self test function to make sure that a sensor functions properly.

DESCRIPTION OF APPLICATION EXAMPLES

Even though today's MEMS based sensors are extremely reliable, there is often a need to verify their functionality through user or system activated testing, especially in safety critical applications. In many sensor products, this testing can be performed only for the electronic circuit of a sensor, but VTI Technologies' advanced 3D MEMS enables also the true verification of the mechanical functionality of the sensor element.

PRINCIPLE OF SELF TEST FUNCTION IN VTI'S PRODUCTS

The true self test in VTI Technologies' sensors simulates acceleration, or deceleration, using an electrostatic force. Internal charge pump of the sensor electronics is activated, and a voltage is applied to the electrodes of the acceleration sensor element. The voltage causes an electrostatic force between the capacitor plate and the proof mass of the element. The electrostatic force simulates acceleration that is high enough to deflect the proof mass to the extreme positive position, and this causes the output signal to go to the maximum value. The self test function is activated by a user or a system given a digital on-off command.

In addition to sensing element, the signal conditioning ASIC is also tested when self test is activated. A parity sum is calculated for the calibration information memory, and if the result differs from the sum stored in the internal memory, the output signal of the sensor is forced to go down. The output stays down until the calculated parity sum is correct, and therefore the self test must be re-activated.

Self Test for Digital SCA61T, SCA100T and SCA103T Products

The self test function is activated digitally by a STX command, and de-activated by a MEAS command.

STX	00001110	Activate Self test
MEAS	00000000	Measurement mode (normal operation mode after power on)

Input high voltage is 4 – Vdd+0.3 V and input low voltage is 0.3 – 1 V. In the SCA100T, SCA103T and SCA1000 series 2-axis products, the self test function must not be activated for both channels at the same time. Self test can be also activated applying logic"1" (positive supply voltage level) to ST pins (pins 9 & 10) of these products. Please see the Data-Sheet of SCA61T, SCA100T and SCA103T.

Analogue Self Test

When the self test (pin 6) is connected to Vdd, the sensor output voltage (pin 7) changes to Vdd, if the sensor is working properly.

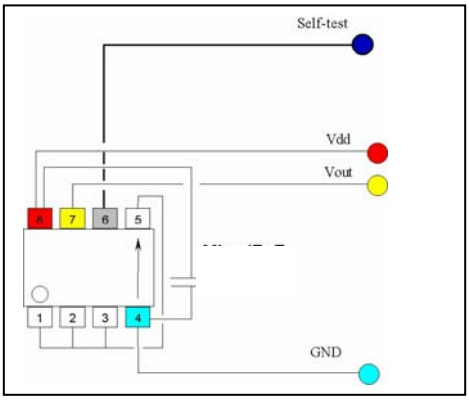
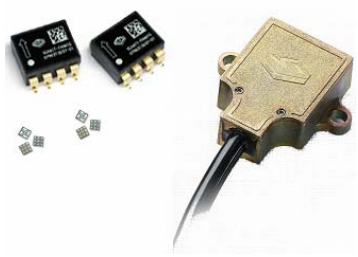


Figure 1. The electrical connection of the self test function.



The self test parameters of the sensors are product specific and they are described in the corresponding product specification documents (for details, please contact VTI Technologies).

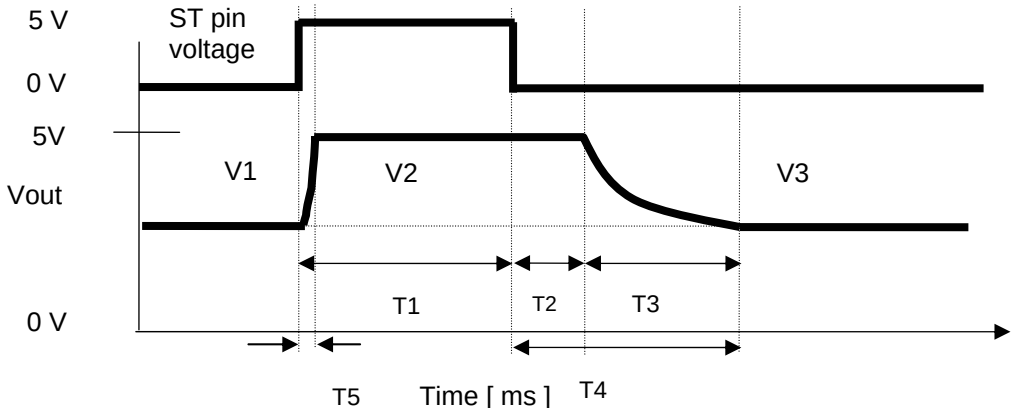
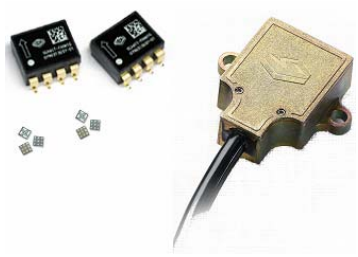


Chart 1. Self test wave forms

V1 = initial output voltage before the self test function is activated.
V2 = output voltage during the self test function.
V3 = output voltage after the self test function has been de-activated and after stabilization time V3=V1.
Please note that the error band specified for V3 is to guarantee that the output is within 5% of the initial value after the specified stabilization time. After a longer time V1=V3.



The following products have the ST characteristics according to the Chart 1.

SCA320-C28H1G, SCA320-CC5V1G, SCA600-C28H1A, SCA600-C23H1A, SCA600-C21H1G, SCA600-C35H1G, SCA600-C35V1G, SCA600-C23H1G, SCA600-C13H1G, SCA1000-D01, SCA1020-D02, SCA1020-D04, SCA610-C23H1A, SCA610-C28H1A, SCA60C, SCA620-CF8H1A

T1: st-on (ms)	T2:Saturation delay (ms) Max	T3: Recovery time (ms) Max	T4:Stabilization time = T2+T3 (ms)	T5: Rise time during self test (ms) Max	V2: Vout during self test (V) Min	V3: Stabilizad output after ST is released
10-100	**20**	**50**	**70**	**10**	**4.75**	**0.95*V1-1.05*V1**

Table 1. Self test characteristics

SCA320-CDCV1G

Product	T1: st-on (ms)	T2:Saturation delay (ms) Max	T3: Recovery time (ms) Max	T4:Stabilization time = T2+T3 (ms)	T5: Rise time during self test (ms) Max	V2: Vout during self test in vertical measurement (V) Min	V3: Stabilizad output after ST is released
SCA320-CDCV1G	**10-100**	**20**	**50**	**70**	**10**	**3,3**	**0.95*V1-1.05*V1**

Table 2. Self test characteristics

SCA61T, SCA100T, SCA103T

T1: st-on (ms)	T2:Saturation delay (ms)	T3: Recovery time (ms)	T4:Stabilization time = T2+T3 (ms)	T5: Rise time during self test (ms)	V2: Vout during self test (V) Min	V3: Stabilizad output after ST is released
20-100	**Typ. 25**	**Typ. 30**	**Typ. 55**	**Typ. 15**	**4.75**	**0.95*V1-1.05*V1**

Table 3. Self test characteristics

NOTE: When using external capacitor, high Cext values (low frequency response) may effect the waveforms due to the low frequency response of the output stage.

The self test function is not intended for the calibration of a sensor.

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